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The use of nanoparticles and Gallic Acid- based additives to reduce atmospheric fume emissions of bitumen

In recent years, the reduction of the emission of toxic substances into the atmosphere during production processes particularly during paving processes of asphalt mixes on the roads has become one of the main objectives of the road pavement industry. The toxicity of these substances is not only limited to the environment but is even greater on the road workers involved in processing bitumen binder as a pure material or in mixtures such as asphalt concrete. In this work, we tested additives with 2 different mechanisms of action. The nanoparticles act by trapping the molecules of bitumen's volatile compounds avoiding their release at high temperatures while the Gallic Acid- based additives decrease asphalt processing temperatures and so the emission of possible toxic fumes is reduced because the work is done below smoke producing temperatures. Thermogravimetry (TGA) and gas chromatography-mass spectrometry (GC-MS) techniques were used for the quantification and characterization of the emitted fumes. The rheological properties of the bitumen binder was characterized using Dynamic Shear Rheology (DSR) alongside the evaluation of possible sedimentation issues that could occur after the addition of the solid additives. This study demonstrated that some Gallic Acid- based additives are also excellent adhesion promoters.

Speaker Biography

Caputo Paolino obtained his PhD in Life Science and Technology from the University of Calabria, Italy. He is currently a post-doc researcher in the department of Chemistry and Chemical Technologies at the University of Calabria. He is also an afferent of the National Inter-University Consortium of Materials Science and Technology (INSTM) which is the largest consortium of its kind in Italy, drawing on the expertise of not less than 50 universities – and all those that are active in Italy in researching advanced materials and technologies. Paolino Caputo's research focuses on physical chemistry with a main focus on bitumen characterization and food based industrial materials and compounds. He has over 35 publications with over 350 citations. He serves as a reviewer for several reputable physical chemistry journals and from October 2020 became a member of the Topic Editorial Board of the journal- Materials. He is also one of the inventors of the Anti-smoke Patent (release date: October 31, 2018; number 102016000041219).

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